Assessing Threats to River Water Quality and Mangrove Health Based on Watershed Land Use on the Osa Peninsula, Costa Rica

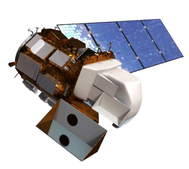
Abstract

The Osa Peninsula, located in the southern region of Costa Rica's Pacific Coast, is one of the most biologically-diverse places on Earth and is a popular ecotourism destination. However, the area faces watershed degradation and loss of biodiversity due to deforestation, pollution from agriculture, and human settlement. NASA DEVELOP worked with Osa Conservation to analyze land use and land cover change in the Osa Peninsula to better understand threats to river water quality and mangrove health. This project used Landsat 5 Thematic Mapper (TM), Landsat 8 Operational Land Imager (OLI), Terra Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), to create a land cover time series map from 1987 to 2017. These time series data were used to compare land use over time, as well as patterns in water quality, mangrove health, erosion, and deforestation. The time series also helped to identify the impact of the creation of protected areas and the 1996 Forest Law 7575, which aimed to support reforestation and riparian health. Osa Conservation will use and distribute results to the National System of Conservation Areas (SINAC), Ministry of Environment and Energy (MINAE), and local communities to inform land management decisions, policy enforcement, education and outreach initiatives, and watershed restoration and monitoring.

Project Partner

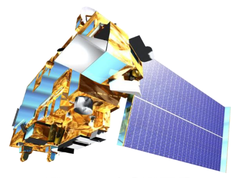
- Osa Conservation

Earth Observations



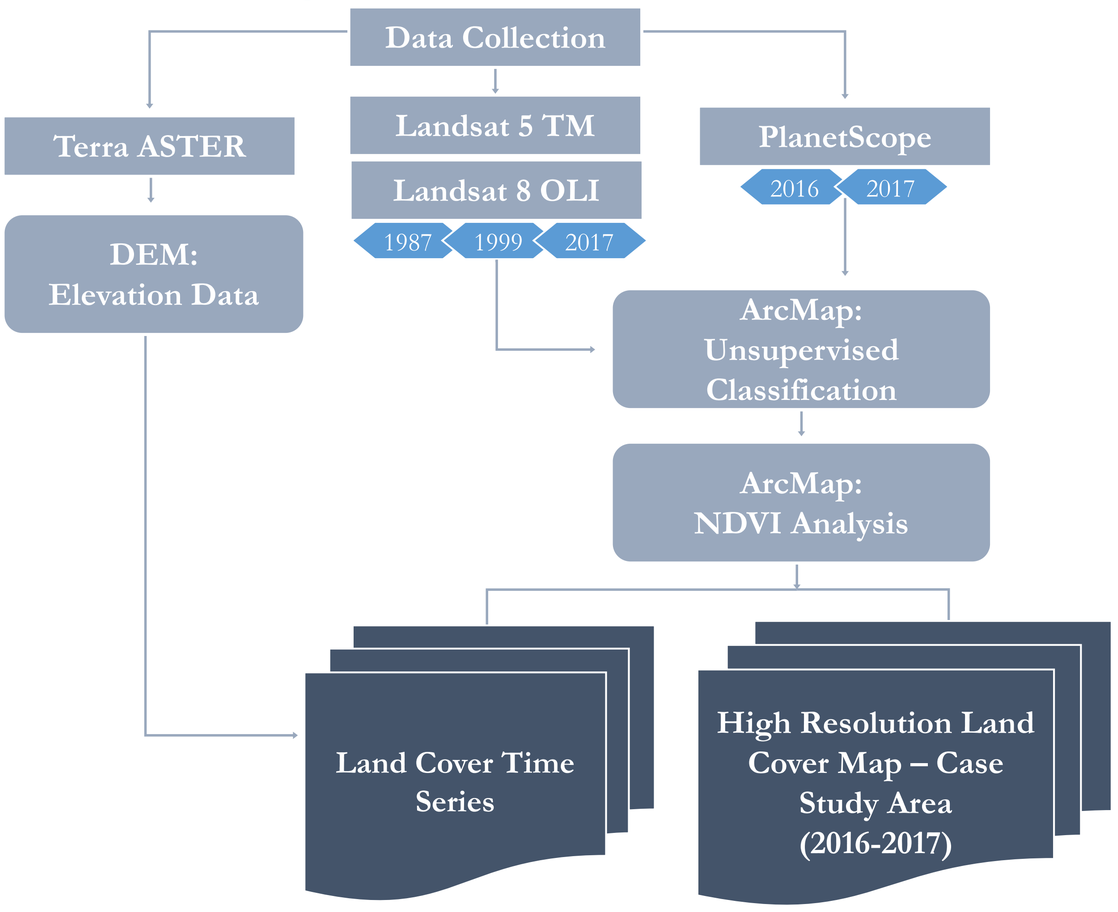
Landsat 8 OLI

Landsat 5 TM



Terra ASTER

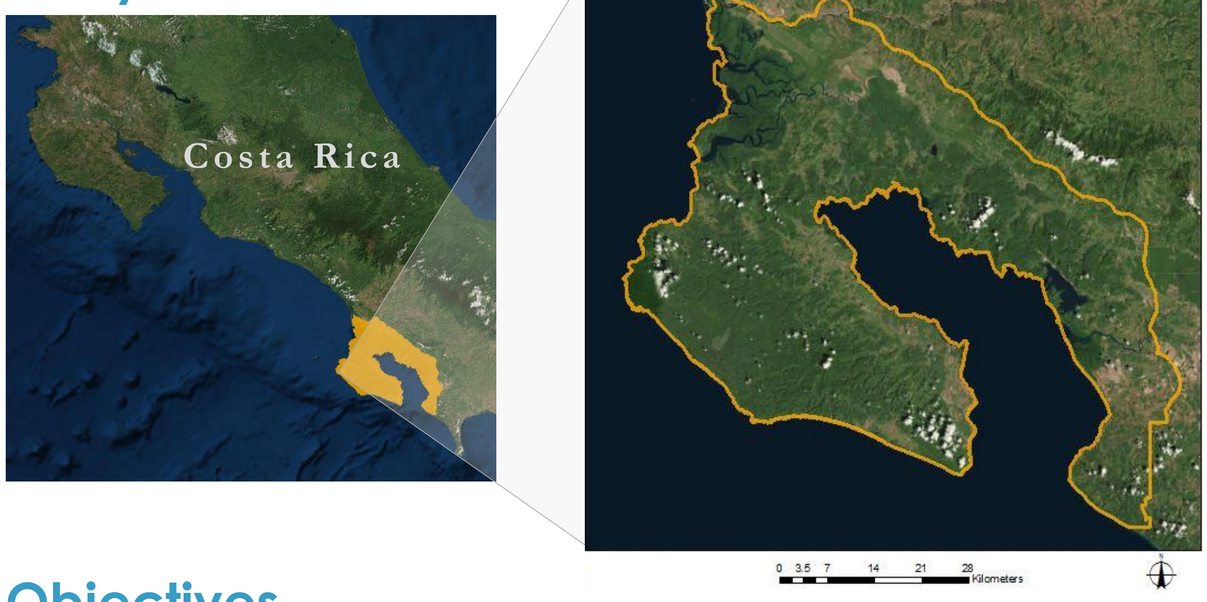
Methodology



Conclusions

- A comparison between the classifications for 1987 and 2017 indicate that palm plantation, urban/bare area, and grassland decreased while negra forra, water, forest, and wetlands increased.
- The Osa Peninsula saw a 10.7% increase in vegetation cover between 1987 and 2017 as indicated by our land cover classification and NDVI analysis.
- These results demonstrate historical land cover change trends and provide insights for evaluating policies and conservation strategies.

Study Area

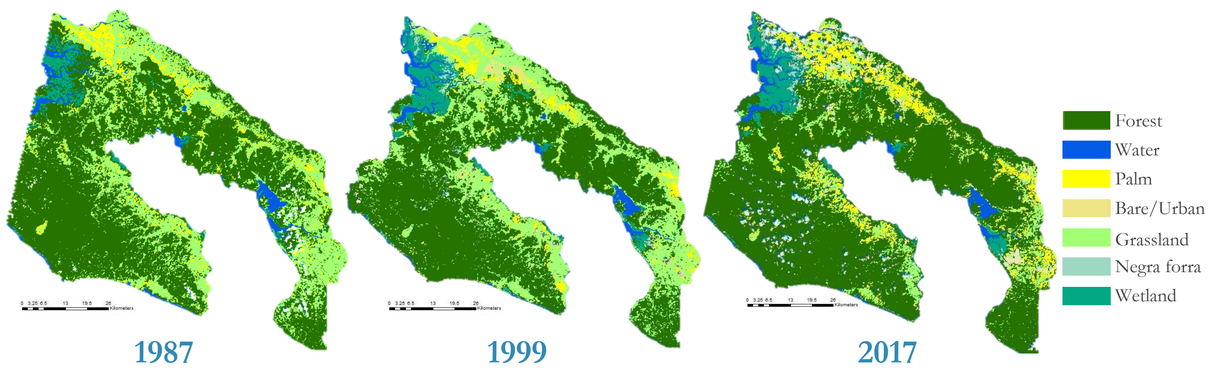


Objectives

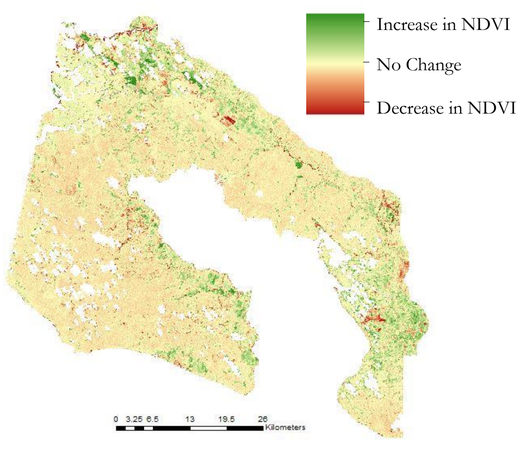
- **Produce** high resolution time series maps of land use and land cover change in the Osa Peninsula for the years 1987, 1999 and 2017.
- **Determine** the rates of land use change in riparian zones.
- **Quantify** the effectiveness of the 1996 Forest Law 7575 in curbing deforestation and erosion in riparian zones.
- **Create** accessible public outreach materials to inform the local community on how to implement sustainable practices.

Results

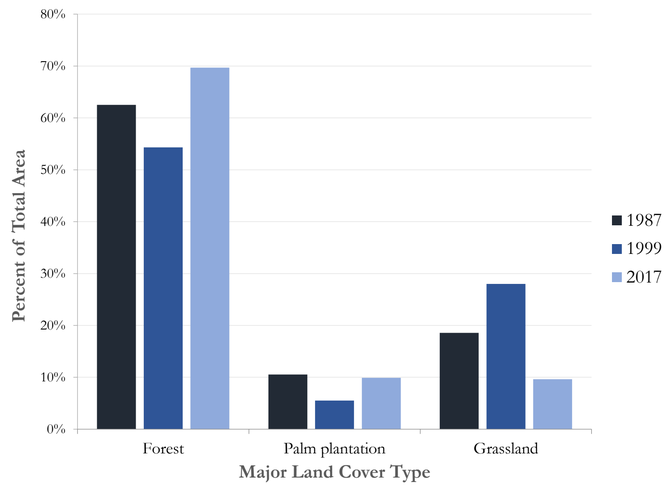
Land Cover Classification



Change in Normalized Difference Vegetation Index (NDVI) between 1987 and 2017



Area of Major Land Cover Types for 1987, 1999 and 2017 (%)



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